

REQUEST FOR RECONSIDERATION

Applicants respectfully request entry of the foregoing and reexamination and reconsideration of the application, as amended, in light of the remarks that follow.

Claims 1, 3, 5-7 and 9-12 are rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5, 057,360 ("Osaka"). Applicants respectfully traverse this rejection because Osaka fails to teach or suggest the limitations of independent Claims 1 and 5 of "sandwiching a green sheet to be baked between spacers; and baking the green sheet to be baked while the green sheet to be baked is sandwiched between the spacers" and that "each of the spacers is a either a green sheet or a calcined sheet each comprising spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component".

To establish a *prima facie* case of obviousness, the prior art reference must teach or suggest all the claim limitations. MPEP §2143.

The present invention provides a ceramic sheet having uniform quality over its entire surface with a decreased number of defects such as foreign matters and flaws. Specification at page 6, lines 21-24. In addition, the present invention provides a method for producing the above-identified ceramic sheets by baking a plurality of green sheets while effectively preventing the generation of defects such as flaws. Specification at page 6, line 26 to page 7, line 3. The present inventors have found that the use of a green sheet or a calcined sheet mainly including spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a spacer is effective in suppressing the flaws generated in the step of baking the green sheet. Specification at page 7, lines 5-9. This is because the use of the spacer can lower the frictional resistance between the spacer and the green sheet to be baked. Specification at page 7, lines 9-11. As a result, the green sheet for ceramic sheet can shrink

with sliding smoothly on the spacer surface during dewaxing and/or sintering in the baking step. Specification at page 7, lines 12-14.

In contrast to the claimed invention, Osaka discloses a ceramic precursor composition, comprising (A) at least one fine ceramic powder selected from the group consisting of zirconia and alumina and having an average particle diameter in the range of 0.01 to 2  $\mu\text{m}$  and (B) a copolymer, a ceramic green sheet made of such ceramic precursor composition, a method for the production of such ceramic green sheet, and a ceramic sheet produced by calcining such ceramic green sheet. Osaka at Abstract. Osaka discloses that the individual particles of the ceramic powder as raw material are desired to be uniform in particle diameter and to have a homoaxially spherical shape. Osaka at column 3, lines 48-51.

To produce Osaka's ceramic green sheet, Osaka discloses a slurry having fine powder and binder homogeneously mixed therein is deaerated under a vacuum, adjusted to a viscosity in the range of 20-100 poises, *applied in the form of sheet on a carrier film with a doctor blade having a fixed gap*, and subsequently heated and dried continuously at a fixed temperature in the range of 40° to 150°C. Osaka at column 7, lines 57-65. Osaka discloses that the ceramic green sheet may be calcined to produce a flat ceramic sheet. Osaka at column 8, lines 7-9, 27-31.

Osaka notes that the doctor blade method is a method for producing a ceramic green sheet by mixing a ceramic powder and an organic solvent, a dispersant, a plasticizer, a binder, etc. thereby preparing a slurry, casting the slurry in a regulated thickness on a carrier film with the aid of a doctor blade, and drying the applied layer of the slurry. Osaka at column 1, lines 14-19. As shown in the attached Appendix 1, the "fixed gap" of the doctor blade referred to in Osaka is the gap between the bottom of the doctor blade and the carrier film.

As mentioned above, "fixed gap" used in Osaka has apparently different meaning from "spacers" used in the claimed invention.

However, Osaka is silent about spacers, and is also silent about baking Osaka's green ceramic sheet while the green ceramic sheet is sandwiched between spacers. Furthermore, Osaka is silent about introducing spherical ceramic particles into spacers used to sandwich a green ceramic sheet during baking. Osaka discloses only the individual particles of ceramic powders as raw material.

Thus, Osaka fails to suggest the limitations of independent Claims 1 and 5 of "sandwiching a green sheet to be baked between spacers; and baking the green sheet to be baked while the green sheet to be baked is sandwiched between the spacers" and that "each of the spacers is a either a green sheet or a calcined sheet each comprising spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component".

Because Osaka fails to teach or suggest all the limitations of independent Claims 1 and 5, Osaka fails to have rendered obvious the claimed invention. Especially, "fixed gap" used in Osaka has apparently different meaning from "spacers" used in the claimed invention. Also Osaka does not suggest nor imply about suppressing the frictional defects generated by friction resulting from the shrinkage of green sheet and/or spacers during baking. Therefore, the rejection under 35 U.S.C. §103(a) over Osaka should be withdrawn. Applicants respectfully request reconsideration and withdrawal of the rejection.

Claims 1-10 are rejected under 35 U.S.C. §103(a) over JP 8151270 ("Kazuo-270"). In addition, Claims 1-10 are rejected under 35 U.S.C. §103(a) over JP 8151271 ("Kazuo-271"). Applicants respectfully traverse these rejections because the cited prior art fails to teach or suggest the limitation of independent Claims 1 and 5 that "each of the spacers is a either a

green sheet or a calcined sheet each comprising spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component". Furthermore, there is no reasonable expectation that the cited prior art would have successfully led the skilled artisan to the spacers of the claimed invention.

As discussed above, to establish a *prima facie* case of obviousness, the prior art references must teach or suggest over claim limitations. MPEP § 2143. In addition, there must be a reasonable expectation of success. *Id.*

Kazuo-270 discloses a porous sheet having less than 5% thermal shrinkage up to the firing temperature is placed on a green sheet and fired to give a ceramic sheet having less than 0.1% warpage. Kazuo-270 at English-language Abstract.

Kazuo-271 discloses placing a green sheet on or between porous sheets having less than 5% thermal shrinkage up to the firing temperature and firing the green sheet to form a ceramic sheet having less than 0.1% warpage. Kazuo-271 at English-language Abstract.

However, Kazuo-270 and Kazuo-271 are silent about the shape of any particles used to form their respective porous sheets. The Final Rejection admits that neither reference teaches particles being of a specific shape or configuration. Final Rejection at page 5, lines 4-5. The Office Action dated May 9, 2001, admits that Kazuo-270 and Kazuo-271 both do not disclose spherical particles., Office Action dated May 9, 2001, at page 5, line 6 and page 6, lines 1-2. Thus, Kazuo-270 and Kazuo-271 fail to suggest the limitation of independent Claims 1 and 5 of spacers comprising "spherical ceramic particles".

Furthermore, Kazuo-270 and Kazuo-271 are silent about the suppression of frictional defects, generated by friction resulting from the shrinkage of green sheet and/or spacers during baking, that is achieved according to the present invention. Instead, JP-270 and JP-

271 rely on a porous sheet having "less than 5% thermal shrinkage" to avoid thermal shrinkage and to obtain a ceramic green sheet having less than 0.1% warpage.

That is, there is no hint or motivation in Kazuo-270 and Kazuo-271 directed to the fact that flows are likely to be generated in a resultant ceramic sheet due to friction between the green sheet and the spacer sheet.

Thus, Kazuo-270 and Kazuo-271 are both (1) silent about the problem addressed by the present invention (frictional defects caused by shrinkage during baking) and (2) Applicants' solution to the problem (spacers comprising spherical ceramic particles).

As a result, there is no reasonable expectation that Kazuo-270 and Kazuo-271 would have successfully led the skilled artisan from the methods of Kazuo-270 and Kazuo-271 for forming ceramic sheet with less than 0.1% warpage to the present invention in which spacers including spherical ceramic particles are used to suppress frictional defect formation when green sheet is baked to form a ceramic sheet.

Because Kazuo-270 and Kazuo-271 fail to teach or suggest the limitation of independent Claims 1 and 5 that "each of the spacers is either a green sheet or a calcined sheet each comprising spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component", and there is no reasonable expectation of success, the rejections under 35 U.S.C. § 103(a) over Kazuo-270 and Kazuo-271 should be withdrawn. Applicants respectfully request reconsideration and withdrawal of the rejections.

Also, there is no reasonable expectation for the person skilled in the art to combine Osaka, which is indifferent to the claimed invention, and Kazuo-270,271, which fails to suggest suppressing the frictional defect, for obtaining ceramic sheet of the claimed invention. Furthermore, it is difficult to predict the effect of the claimed invention from these

references. Therefore, the effects of the claimed invention cannot be anticipated from the references.

In view of the foregoing amendments and remarks, Applicants respectfully submit that the application is in condition for allowance. Applicants respectfully request favorable consideration and prompt allowance of the application.

Should the Examiner believe that anything further is necessary in order to place the application in even better condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



Norman F. Oblon  
Attorney of Record  
Registration No. 24,618

Corwin P. Umbach, Ph.D.  
Registration No. 40,211

Attachments:

Marked-up copy of amendments  
Appendix 1



**22850**

(703) 413-3000  
Fax #: (703) 413-2220  
NFO/CPU:cja



MARKED-UP COPY OF AMENDMENTS

Marked-Up Copy
Serial No. 09 1445,423
Amendment Filed on: MAY 9, 2002

IN RE APPLICATION OF:

KAZUO HATA ET AL

: EXAMINER: FERGUSON L.

SERIAL NO. : 09/445,423

: GROUP ART UNIT: 1774

FILED: DECEMBER 10, 1999  
FOR: CERAMIC SHEET AND METHOD  
OF PRODUCING CERAMIC SHEET

AMENDMENT AFTER FINAL REJECTION

ASSISTANT COMMISSIONER FOR PATENTS  
WASHINGTON, D.C. 20231

SIR:

In response to the Final Rejection dated January 9, 2002, the period for response having been extended to May 9, 2002, by a petition for extension of time filed herewith, please amend the application identified above as follows (marked-up copy of amendments attached):

IN THE CLAIMS

Please amend Claims 1 and 5-8 as follows:

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1. (Amended) A ceramic sheet having not more than 5 defects in an area having a length of 30 mm or less, the defect being detected based on an image obtained with a charge coupled device (CCD) camera, wherein

the ceramic sheet is produced by a process comprising steps of:

sandwiching a green sheet to be baked between spacers; and

baking the green sheet to be baked while the green sheet to be baked is

sandwiched between the spacers, where

each of the spacers is either a green sheet or a calcined sheet each including spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component.

5. (Amended) A method for producing a ceramic sheet, the method comprising steps of:

sandwiching a green sheet to be baked [by] between spacers; and

baking the green sheet to be baked while [being] the green sheet to be baked is sandwiched between the spacers, [wherein] where

each of the [spacer] spacers is a either a green sheet or a calcined sheet each comprising spherical ceramic particles having an average particle diameter of 0.1 to less than 5  $\mu\text{m}$  as a main component.

6. (Amended) A method for producing a ceramic sheet according to claim 5, wherein the content of the spherical ceramic particles is 80 wt% or larger with respect to the weight of the total ceramics contained in each of the [spacer] spacers.

7. (Amended) A method for producing a ceramic sheet according to [claim] claims 5 [to] or 6, wherein each of the [spacer is a green sheet or a calcined sheet having] spacers has a sintering temperature of 50 to 300°C higher than the sintering temperature of the green sheet to be baked.

8. (Amended) A method for producing a ceramic sheet according to claims 5 [to 7] or 6, wherein [when]

at least one of the [spacer] spacers is a green sheet, and  
the [spacer is calcined] baking calcines the at least one of the spacers into a porous sheet having a porosity of 5 to 60% [during the step of baking the green sheet to be baked to produce the ceramic sheet].

Please add new Claim 13 as follows:

--13. (New) A spacer according to claim 1, wherein the content of the spherical ceramic particles is 80 wt% or larger with respect to the weight of the total ceramics contained in the spacer.--